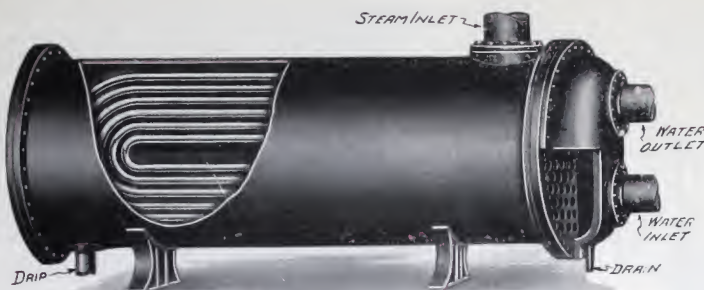


WHITLOCK TYPE "R" INSTANTANEOUS HEATERS



Type "R"
Instantaneous
Heaters

Fig. 1. Type R Instantaneous Heater

Whitlock Type "R" Instantaneous Heaters are favored by a large and ever increasing number of Architects and Engineers because of their compactness, their simplicity of construction, and because they are peculiarly adapted to several important classes of service. The following description of the details of their construction clearly shows the reason for this favor.

DETAILS OF CONSTRUCTION

Heating Section

The heating section is made up of U-bends of heavy gauge seamless drawn copper tubing, both ends of which are expanded into a heavy rolled steel tube sheet.

This design makes a particularly compact tube bundle which can be readily removed from the shell if necessary. With the U-tube construction, the heating section is fixed to the shell at one end only so that any amount of expansion and contraction of the shell or heating section, is automatically taken care of independently of any other part.

Shell

For low steam pressures, on the smaller size heaters, the shells are made of the best commercial grade of cast iron. Larger sizes are furnished with riveted or welded steel shells, with joints properly designed for the working pressures to which they are to be subjected. When the heaters are to be subjected to high steam pressures the shells are made of steel pipe with Van Stone end flanges.

Connections up to and including $2\frac{1}{2}$ " diameter are properly bossed and tapped to the shell directly. Larger size connections are made to saddleports, cast integral with the shell, faced and drilled for A. S. M. E. flanges. For steel shells saddleports are either riveted or welded to the shell.

A baffle plate, located in the steam inlet, serves both to distribute the steam over the entire heating section and to protect the tubes from the erosion caused by the direct impact of the steam.

Heads

Both front and rear heads are ordinarily furnished of heavy cast iron but for high pressure work heads of cast steel can be furnished.

The front head, or water distributing chamber, is ribbed to direct the water through the proper number of tubes. These ribs are designed to conform to the tube arrangement making the heater a two, four or multipass heater as conditions of service require. (See Explanation on Page 5)

Test

Every Whitlock Type "R" Heater is submitted to a hydrostatic test pressure of 50% in excess of the working pressure specified. Both heater shell and heating section must be absolutely tight under this test in order to receive the Whitlock Certificate of Inspection which is our guarantee that the heater, as shipped, is entirely free from leaks. This certificate is forwarded to the customer with the shipping papers.

USES FOR INSTANTANEOUS HEATERS

Mention has already been made of the fact that certain features of the design of these heaters make them well fitted for many important classes of service.

The instantaneous heater is primarily designed for conditions demanding a constant, or nearly constant, supply of water at a given temperature. This ideal condition is rarely, if ever, attained. It is, however, a well established practice to use this type of heater for various services where this condition is approximated.

Complete descriptions of the more common uses for the instantaneous heater are given on the following pages.

Capacities and Roughing-In Dimensions for Whitlock Type "R" Instantaneous Heaters

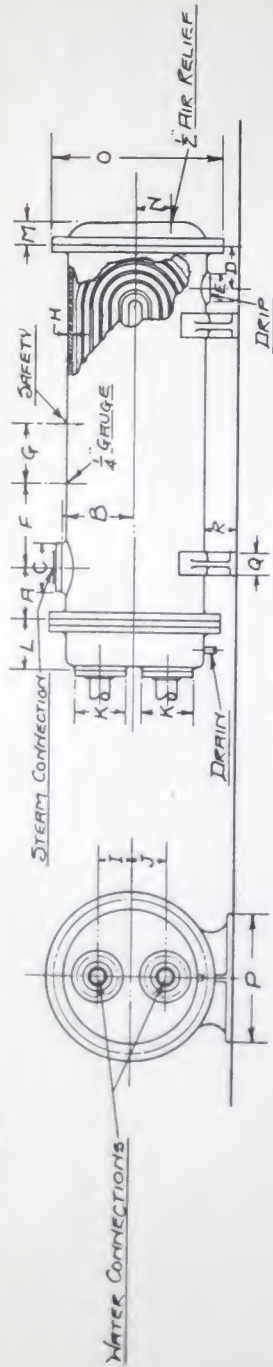


Fig. 2

TABLE 1 — TWO-PASS

Temperature range 40° F to 80° F based on using steam at 0 lb. gage

Heater No.	Velocity In Ft. Per Min.	Capacity (Per Hour)	Length Overall	Weight	SHELL										WATER DISTRIBUTING CHAMBER				HEAD REAR			CRADLES									
					Diam.	Length	Water.	Steam Inlet	Drip	A	B	C	D	E	F	G	H	Diam.	Water Conns.	Drain	I	J	K	L	M	N	O	P	Q	R	
0	91	151	11 1/2	90	4	10	10	10	10	10	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
1	37	350	14 1/2	110	4	15	15	15	15	15	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
2	68	650	19 1/2	130	4	20	20	20	20	20	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
3	117	1100	23 1/2	145	4	25	25	25	25	25	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	4 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
4	170	1600	28 1/2	170	4	30	30	30	30	30	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
5	202	1900	34 1/2	240	4	35	35	35	35	35	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
6	135	2550	24 1/2	270	4	40	40	40	40	40	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
7	170	3200	30 1/2	300	4	45	45	45	45	45	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
8	271	5100	43 1/2	360	4	50	50	50	50	50	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
9	338	6350	53 1/2	420	4	55	55	55	55	55	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
10	438	7950	65 1/2	610	4	60	60	60	60	60	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
11	188	9550	81 1/2	670	4	65	65	65	65	65	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
12	226	12700	97 1/2	810	4	70	70	70	70	70	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
13	300	15900	113 1/2	930	4	75	75	75	75	75	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
14	218	19100	139 1/2	1040	4	80	80	80	80	80	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
15	267	25600	165 1/2	1320	4	85	85	85	85	85	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
16	325	31700	211 1/2	1510	4	90	90	90	90	90	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
17	264	38200	261 1/2	1700	4	95	95	95	95	95	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
18	357	50100	341 1/2	2100	4	100	100	100	100	100	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
19	357	57100	391 1/2	2500	4	105	105	105	105	105	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
20	252	63450	441 1/2	3000	4	110	110	110	110	110	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
21	317	79300	541 1/2	3500	4	115	115	115	115	115	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
22	266	95100	641 1/2	4200	4	120	120	120	120	120	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
23	334	126400	83 1/2	4780	4	125	125	125	125	125	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
24	280	158400	78 1/2	5530	4	130	130	130	130	130	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—
25	351	191000	80 1/2	7080	4	135	135	135	135	135	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	5 1/2	1 1/2	1 1/2	9 1/2	—	—	—	—	—	—

All dimensions are in inches.
Sizes 0 to 10 have 3/4" O. D. No. 18 B. W. G. Copper tube.
Larger sizes have 1" O. D. No. 17 B. W. G. Copper tubes
(Continued on pages 4 and 5)

Instantaneous Heaters with Storage Tanks

This arrangement is to be desired when hot water demand fluctuates greatly. Continual heating stores water for the peak load while allowing a more uniform load on the boiler.

If the heater is to operate in connection with a storage tank by gravity circulation we should be advised before the order is placed. The reason for this is that the low velocity, of 50 to 60 feet per minute, which may be expected with this type of installation, demands properly proportioned connections and interconnecting pipe lines.

To estimate the size heater required for this service, heating water to 180°F. with atmospheric steam, figure on a two pass heater having a capacity of 50% of the listed rating of a multipass heater as shown in Table 1.

For forced circulation with a pump, the proper heater size may be read directly from the tables for the temperature ranges shown.

Before deciding to install a storage tank with an independent heater connected to it we strongly recommend a careful consideration of our Whitlock Type "K" Storage Heater as shown in Bulletin 40.

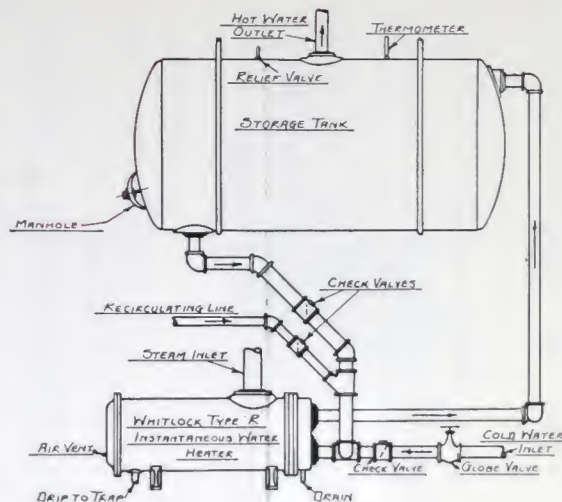


Fig. 3

Type "R" Heater as Auxiliary with Storage Tank—Gravity Circulation.

Swimming Pool Heaters

The water is heated as it goes to the pool for the first time or as it is re-circulated through filters and purifiers to the pool again. Best practice calls for a heater capable of heating the entire contents of the pool from 40° to 80° F. in from ten to twelve hours.

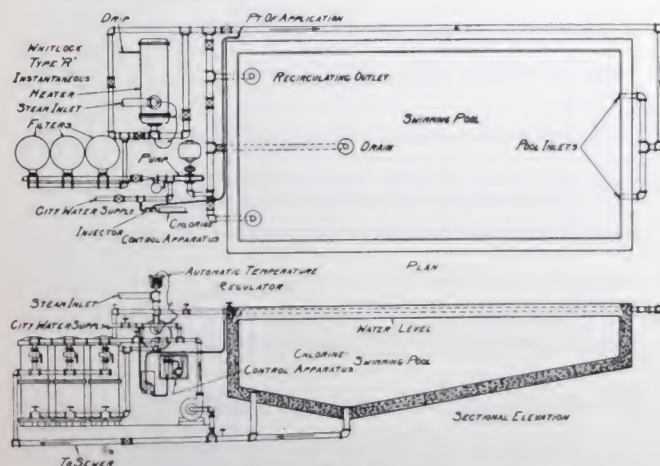


FIG. 4

Arrangement of Type "R" Swimming Pool Heater with Filters, Pumps, etc.

TABLE 2
CAPACITIES OF WHITLOCK TYPE "R" 2 PASS SWIMMING POOL HEATERS

GALS. PER HOUR. WATER HEATED FROM 40°-80° F.

Heater Number	0 #				2 #				5 #				Maximum Water	Maximum Steam
	Gals. Per Hour	Water Conn.	Steam Conn.	Gals. Per Hour	Water Conn.	Steam Conn.	Gals. Per Hour	Water Conn.	Steam Conn.	Gals. Per Hour	Water Conn.	Steam Conn.		
0	150	3/4"	1 1/4"	187	3/4"	1 1/4"	238	1"	1 1/4"	2	1 1/4"	3	2	3
1	350	1 1/4"	1 1/2"	400	1 1/4"	1 1/2"	455	1 1/4"	1 1/2"	2	1 1/2"	3	2	3
2	650	1 1/2"	1 3/4"	750	1 1/2"	1 3/4"	800	1 1/2"	1 3/4"	2	1 3/4"	3	2	3
3	1100	2"	2"	1300	2"	2"	1390	2"	2"	2	2"	3	2	3
4	1600	2 1/2"	2 1/2"	1690	2 1/2"	2 1/2"	1800	2 1/2"	2 1/2"	2	2 1/2"	3	2	3
5	1900	3"	3"	2190	3"	3"	2300	3"	3"	2	3"	3	2	3
6	2550	3 1/2"	3 1/2"	2880	3 1/2"	3 1/2"	3080	3 1/2"	3 1/2"	3	3 1/2"	4	3	4 1/2
7	3200	4"	4"	3370	4"	4"	3590	4"	4"	3	4"	4	3	4 1/2
8	3800	4 1/2"	4 1/2"	4340	4 1/2"	4 1/2"	4630	4 1/2"	4 1/2"	4	4 1/2"	5	4	5 1/2
9	5100	5"	5"	5780	5"	5"	6170	5"	5"	4	5"	6	4	5 1/2
10	6350	6"	6"	7230	6"	6"				5	6"	7	5	6 1/2
11	7950	6 1/2"	6 1/2"	9050	6 1/2"	6 1/2"	9650	6 1/2"	6 1/2"	6	6 1/2"	8	6	7
12	9550	7"	7"	10550	7"	7"	11250	7"	7"	6	7"	9	6	7
13	12700	8"	8"	14000	8"	8"	14900	8"	8"	7	8"	10	7	8
14	15900	9"	9"	17000	9"	9"	18100	9"	9"	8	9"	11	8	9
15	19100	10"	10"	20800	10"	10"	22200	10"	10"	8	10"	12	9	10
16	25600	12"	12"	28600	12"	12"				10	12"	14	11	12
17	31700	14"	14"	35100	14"	14"				12	14"	16	13	14

FOR COMPLETE TABLES WRITE FOR SHEET D59A

Capacities and Roughing-In Dimensions for Whitlock Type "R" Instantaneous Heaters

(Continued from page 2)

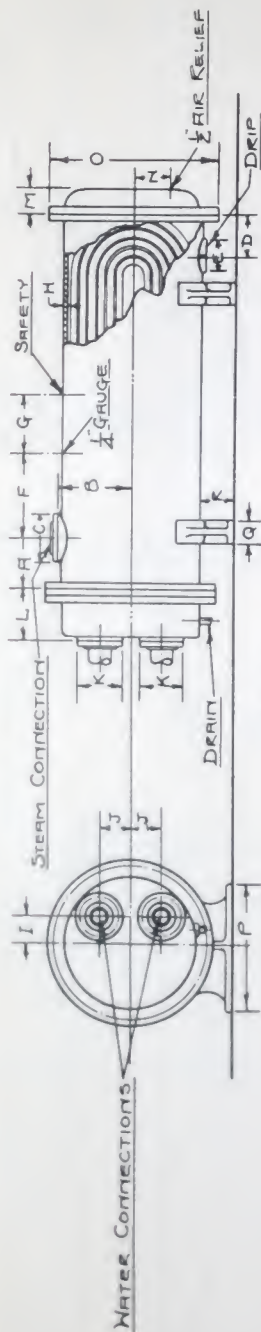


Fig. 5

TABLE 3—FOUR-PASS

Temperature range 40° F to 120° F based on using steam at 0 lb. gage

Heater No.	Velocity In Ft. Per Min.	Capacity (Gallons Per Hour)	Length Overall	Weight	SHELL										WATER DISTRIBUTING CHAMBER							HEAD REAR			CRADLES			
					Diap.	Length	Mat.	Steam Inlet	Drp	A	B	C	D	E	F	G	H	Diam.	Water Conns.	Drain	I	J	K	L	M	N	O	P
0	21	50	11 1/4	100	12	1	1	1 1/2	1 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
1	22 1/2	150	10 1/4	100	12	1	1	1 1/2	1 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
2	23 1/2	300	21 1/4	115	12	1	1	1 1/2	1 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
3	24 1/2	450	20 1/4	135	22	2	2	2 1/2	2 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	25 1/2	600	21 1/4	150	27	3	3	3 1/2	3 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
5	26 1/2	750	28 1/4	180	34	4	4	4 1/2	4 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6	27 1/2	900	29 1/4	220	39	4	4	4 1/2	4 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7	28 1/2	1050	30 1/4	250	44	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8	29 1/2	1200	30 1/4	300	49	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9	30 1/2	1400	35 1/4	350	55	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
10	31 1/2	1600	43 1/4	420	60	7	7	7 1/2	7 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
11	32 1/2	1800	43 1/4	450	65	8	8	8 1/2	8 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12	33 1/2	2000	52 1/4	620	12	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
13	34 1/2	2200	52 1/4	650	12	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
14	35 1/2	2400	55 1/4	700	12	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
15	36 1/2	2600	55 1/4	800	12	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
16	37 1/2	2800	65 1/4	940	15	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17	38 1/2	3000	71	1070	15	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
18	39 1/2	3200	71	1300	17	5	5	5 1/2	5 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
19	40 1/2	3400	82 1/4	1580	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
20	41 1/2	3600	82 1/4	1820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
21	42 1/2	3800	92 1/4	2020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
22	43 1/2	4000	92 1/4	2220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
23	44 1/2	4200	92 1/4	2420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
24	45 1/2	4400	92 1/4	2620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
25	46 1/2	4600	92 1/4	2820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
26	47 1/2	4800	92 1/4	3020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
27	48 1/2	5000	92 1/4	3220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
28	49 1/2	5200	92 1/4	3420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
29	50 1/2	5400	92 1/4	3620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
30	51 1/2	5600	92 1/4	3820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
31	52 1/2	5800	92 1/4	4020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
32	53 1/2	6000	92 1/4	4220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
33	54 1/2	6200	92 1/4	4420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
34	55 1/2	6400	92 1/4	4620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
35	56 1/2	6600	92 1/4	4820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
36	57 1/2	6800	92 1/4	5020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
37	58 1/2	7000	92 1/4	5220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
38	59 1/2	7200	92 1/4	5420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
39	60 1/2	7400	92 1/4	5620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
40	61 1/2	7600	92 1/4	5820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
41	62 1/2	7800	92 1/4	6020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
42	63 1/2	8000	92 1/4	6220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
43	64 1/2	8200	92 1/4	6420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
44	65 1/2	8400	92 1/4	6620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
45	66 1/2	8600	92 1/4	6820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
46	67 1/2	8800	92 1/4	7020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
47	68 1/2	9000	92 1/4	7220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
48	69 1/2	9200	92 1/4	7420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
49	70 1/2	9400	92 1/4	7620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
50	71 1/2	9600	92 1/4	7820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
51	72 1/2	9800	92 1/4	8020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
52	73 1/2	10000	92 1/4	8220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
53	74 1/2	10200	92 1/4	8420	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
54	75 1/2	10400	92 1/4	8620	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
55	76 1/2	10600	92 1/4	8820	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
56	77 1/2	10800	92 1/4	9020	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
57	78 1/2	11000	92 1/4	9220	20	6	6	6 1/2	6 1/2	3 1/2	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
58	79 1/2	11200	92 1/4	9420	20	6	6	6 1/2	6 1/2	3 1/2																		

Sizes 0 to 10 have 3/4" O. D. No. 18 B. W. G. Copper tubes.
Larger sizes have 1" O. D. No. 17 B. W. G. Copper tubes.

TABLE 4—MULTIPASS
Temperature range 40° F to 180° F based on using steam at 0 lb. gage

Heater No.	Velocity In Ft. Per Min.	Capacity Gallons Per Hour	Length Overall	Weight	SHELL										HEAD EXPANSION TYPE						HEAD REAR			CRADLES									
					Drip	A	B	C	D	E	F	G	H	Diam.	Water Conns.	Drain	I	J	K	L	M	N	O	P	Q	R							
0	25	25	153	90	7	11	1	1	3 1/4	3	4	3	3	3	3	6	6	3 1/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—
1	60	60	203 3/8	125	7	22	1 1/4	1 1/4	3/4	3	4	3	3	3	3	6	6	3 1/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—
2	144	150	373 3/8	160	7	33	1 1/4	1 1/4	3/4	3	5 1/4	3 1/2	3	3 1/2	8	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
3	200	200	392 1/2	280	9 1/2	34	1 1/4	1 1/4	3/4	4	5 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
4	240	250	48 1/2	325	9 1/2	43	1 1/4	1 1/4	3/4	4	6 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
5	143	300	31 3/4	250	9 1/2	26	1 1/4	1 1/4	3/4	4	7 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
6	191	400	40 3/4	300	9 1/2	35	1 1/4	1 1/4	3/4	4	8 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
7	160	500	43 3/4	325	9 1/2	43	1 1/4	1 1/4	3/4	4	9 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
8	192	600	48 3/4	325	9 1/2	43	1 1/4	1 1/4	3/4	4	10 1/4	3 1/2	4	3 1/2	10	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
9	139	800	52	575	12	51	1 1/4	1 1/4	3/4	4	11 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
10	174	1250	62	645	12	51	1 1/4	1 1/4	3/4	4	12 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
11	217	1500	74	760	12	67	1 1/4	1 1/4	3/4	4	13 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
12	156	1500	59 7/8	870	15	52	1 1/4	1 1/4	3/4	4	14 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
13	208	2000	72 1/2	1020	15	65	1 1/4	1 1/4	3/4	4	15 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
14	162	2500	59	1035	17	51	1 1/4	1 1/4	3/4	4	16 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
15	195	3000	71	1175	17	63	1 1/4	1 1/4	3/4	4	17 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
16	260	4000	89	1420	17	81	1 1/4	1 1/4	3/4	4	18 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
17	216	5000	74 7/8	1910	20	66	1 1/4	1 1/4	3/4	4	19 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
18	259	6000	88 7/8	2185	20	66	1 1/4	1 1/4	3/4	4	20 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
18 1/2	310	8000	101 3/8	2810	20	66	1 1/4	1 1/4	3/4	4	21 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
19	193	9000	71 1/2	2810	26	51	1 1/4	1 1/4	3/4	4	22 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
19 1/2	217	10000	71 1/2	3000	26	68	1 1/4	1 1/4	3/4	4	23 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
20	271	12500	94 1/2	3220	26	68	1 1/4	1 1/4	3/4	4	24 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
21	271	12500	94 1/2	3725	26	84	1 1/4	1 1/4	3/4	4	25 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
22	230	15000	89	4125	30	80	1 1/4	1 1/4	3/4	4	26 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
23	307	20000	113	4680	30	104	1 1/4	1 1/4	3/4	4	27 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
24	260	25000	96	6350	36	86	1 1/4	1 1/4	3/4	4	28 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—
25	312	30000	112	7175	36	102	1 1/4	1 1/4	3/4	4	29 1/4	3 1/2	4	3 1/2	12	8	3/4	9 1/4	3 1/4	1 1/2	1 1/2	9 1/4	—	—	—	—	—	—	—	—	—	—	—

Sizes 0 to 8 have 3/4" O. D. No. 18 B. W. G. Copper tubes

Larger sizes have 1" O. D. No. 17 B. W. G. Copper tubes.

The above tables show the standard sizes only. For such service as converters (see pages 6 and 7) for which heaters of special proportions are frequently required to meet certain operating conditions, special drawings will be furnished on request.

With steam pressures above atmospheric pressure a smaller heater may be used for the same capacity. Specifications will be gladly furnished on request.

Specifications for Whitlock Type "R" Instantaneous Heaters

Furnish and install as shown on plans one Whitlock Type "R" Instantaneous Heater as manufactured by The Whitlock Coil Pipe Company, Hartford, Conn.

Capacity: The heater shall be capable of heating (?) gallons of water per hour, from (?) to (?)°F. when supplied with sufficient steam at (?) pounds gauge pressure. The heater shall operate with water inside of the tubes, the steam being in the shell around the tubes. The heater shall be arranged for operation in a horizontal (or vertical) position as shown on plans. Cast iron cradles (or vertical supporting legs) shall be furnished.

Construction: The heater shall be furnished with the necessary steam, condensation, water and

drain connections of sizes as recommended and guaranteed by the heater manufacturer to be suitable for the duty specified. Shell, water chamber and heads shall be of close grain cast iron of the best commercial grade; tube sheet steel; heating section of seamless drawn copper tubing made up into U-bends with ends securely expanded into the steel tube sheet.

Working Pressure: The heater shall be suitable for a working pressure of (?) pounds on the shell side and (?) pounds on the tube side.

Test: Before shipment, both the shell and tube side of the heater shall be submitted to a hydrostatic test pressure of 50% in excess of the working pressures specified.

The Significance of the Number of "Passes":

The determination of the number of "passes" in any multitubular type of instantaneous heater is a very important element of design but is simply a means to an end. Having chosen the proper size of heater for any given set of operating conditions the next step is to adjust the relation between the heating surface and the cross sectional area of the liquid passages. The purpose of this adjustment is to obtain the maximum effectiveness from the heating surface by maintaining a high liquid velocity, and at the same time to keep the pressure drop on the liquid side within permissible limits.

These matters of routine design are taken care of by our Engineering and Drafting Departments.

Sizes of Whitlock Type "R" Convertors for Various Duties

 TABLE 6
 FORCED CIRCULATION

Gals. Per Min.	Steam at 0 Lbs. Gauge					
	160°-180°	160-185°	170-185°	170-190°	170-200°	160-185°
10	3-4	4-4	5-M	5-M	7-M	6-M
20	6-4	7-4	8-4	8-4	10-M	9-M
30	8-4	9-4	10-4	10-4	11-M	11-M
40	9-4	10-4	11-4	11-4	13-M	13-M
50	10-2	11-4	13-M	12-4	14-M	15-M
75	100-13-2	13-4	14-M	16-4	17-M	16-4
100	12-4	14-4	16-4	15-4	18-4	17-4
125	14-4	15-4	16-4	17-4	18-4	18-4
150	15-4	16-4	18-4	18-4	19-4	19-4
175	15-2	17-4	18-4	19-4	19-4	19-4
200	17-2	18-4	19-4	19-4	20-4	20-4
250	18-4	19-4	20-4	21-4	21-4	21-4
300	18-4	19-4	20-4	21-4	22-4	22-4
350	18-4	19-4	20-4	21-4	23-4	23-4
400	18-4	19-4	20-4	22-4	24-4	24-4
450	19-2	20-4	21-4	23-4	25-4	25-4
500	19-2	20-4	21-4	24-4		
550	20-4	21-4	22-4	25-4		
600	20-4	21-4	22-4			
650	21-2	22-4				
700	21-2	23-4				
750	21-2	24-4				
800	21-2	25-4				
900	22-2					

 TABLE 8
 FORCED CIRCULATION

Gals. Per Min.	Steam at 10 lbs. Gauge											
	180°	160°	180°	170°	160°	180°	170°	160°	180°	170°	160°	170°
10	2-4	2-4	3-4	3-4	3-4	4-4	4-4	4-4	5-4	5-4	6-M	5-M
20	4-4	5-4	6-4	6-4	6-4	7-4	7-4	7-4	8-4	8-4	8-4	8-4
30	5-2	6-4	7-4	7-4	7-4	8-4	8-4	8-4	9-4	9-4	10-M	9-4
40	6-4	8-4	9-4	9-4	9-4	10-4	10-4	10-4	11-4	11-4	12-M	11-4
50	8-4	9-4	10-2	10-2	10-2	11-4	11-4	11-4	12-4	12-4	13-M	12-4
75	9-2	10-2	11-4	11-4	11-4	12-4	12-4	12-4	13-4	13-4	14-M	13-4
100	10-2	11-2	12-4	12-4	12-4	13-4	13-4	13-4	14-4	14-4	15-M	14-4
125	11-2	12-4	13-4	13-4	13-4	14-4	14-4	14-4	15-4	15-4	16-4	15-4
150	12-2	13-4	14-4	14-4	14-4	15-4	15-4	15-4	16-4	16-4	17-4	16-4
175	12-2	13-4	14-4	15-4	15-4	16-4	16-4	16-4	17-4	17-4	18-4	17-4
200	13-2	14-4	15-4	16-4	16-4	17-4	17-4	17-4	18-4	18-4	19-4	18-4
250	15-2	16-4	17-4	18-4	18-4	19-4	19-4	19-4	20-4	20-4	21-4	20-4
300	16-2	17-4	18-4	19-4	19-4	20-4	20-4	20-4	21-4	21-4	22-4	21-4
350	16-2	17-4	18-4	19-4	19-4	20-4	20-4	20-4	21-4	21-4	22-4	22-4
400	16-2	17-4	18-4	19-4	19-4	20-4	20-4	20-4	21-4	21-4	22-4	22-4
450	17-2	18-4	19-4	20-4	20-4	21-4	21-4	21-4	22-4	22-4	23-4	23-4
500	17-2	18-4	19-4	20-4	20-4	21-4	21-4	21-4	22-4	22-4	24-5	24-4
550	18-2	19-4	20-4	21-4	21-4	22-4	22-4	22-4	23-4	23-4	25-4	25-4
600	18-2	19-4	20-4	21-4	21-4	22-4	22-4	22-4	24-4	24-4		
650	18-2	19-4	20-4	21-4	21-4	22-4	22-4	22-4	25-4	25-4		
700	19-2	20-4	21-4	22-4	22-4	23-4	23-4	23-4	26-4	26-4		
750	19-2	20-4	21-4	22-4	22-4	24-4	24-4	24-4	27-4	27-4		
800	19-2	20-4	21-4	22-4	22-4	25-4	25-4	25-4	28-4	28-4		
900	20-2	21-4	22-4	23-4	23-4	26-4	26-4	26-4	29-4	29-4		
1000	20-2	21-4	22-4	23-4	23-4	27-4	27-4	27-4	30-4	30-4		
1100	21-2	22-4	23-4	24-4	24-4	28-4	28-4	28-4	31-4	31-4		
1200	21-2	22-4	23-4	24-4	24-4	29-4	29-4	29-4	32-4	32-4		
1400	23-2											

NOTE:—First Figure indicates Size of Heater; Second Figure indicates Number of Passes. S indicates a Special Heater having same diameter as a Standard Two Pass Heater, but of a shorter overall length. Exact specifications on application.

 TABLE 5
 GRAVITY CIRCULATION

Square Ft. Of Total Radiation	160°-180° 150 B.T.U. Per Sq. Ft. Radiation Per Hr. Steam Pressure						160°-190° 150 B.T.U. Per Sq. Ft. Radiation Per Hr. Steam Pressure					
	0#	5#	10#	20#	30#		0#	5#	10#	20#	30#	
1,000	8	6	6-S	6-S	6-S		9	6	5	4	3	
1,500	9	7	6	6-S	6-S		10	7	5	6	6-S	
2,000	11	11-S	11-S	11-S	11-S		11	9	8	7	6	
2,500	12	11	11	11-S	11-S		12	11-S	11-S	11-S	11-S	
3,000	12	11	11	11-S	11-S		13	11	11	11-S	11-S	
3,500	13	12	11	11-S	11-S		14	11	11-S	11-S	11-S	
4,000	14	14	14	14	14		14	12	11	11	11-S	
4,500	15	14	14	14	14		15	13	12	11	11-S	
5,000	16	16-S	16-S	16-S	16-S		16	13	12	11	11-S	
5,500	17	18	18-S	18-S	18-S		17	15	14	14	14-S	
6,000	18	18-S	18-S	18-S	18-S		18	16	16-S	16-S	16-S	
6,500	18½	18-S	18-S	18-S	18-S		19	17	16	16-S	16-S	
7,000	19	19½	19½	19½-S	19½-S		19½	18	18-S	18-S	18-S	
7,500	19½	19½	19½	19½-S	19½-S		20	18	18-S	18-S	18-S	
8,000	20	19½	19½	19½-S	19½-S		21	19½	19½-S	19½-S	19½-S	
8,500	20½	20	20	20-S	20-S		21½	19½	19½-S	19½-S	19½-S	
9,000	21	20	20	20-S	20-S		22	19½	19½-S	19½-S	19½-S	
9,500	21½	21	21	21-S	21-S		22½	20	20-S	20-S	20-S	
10,000	22	21	21	21-S	21-S		23	21	20-S	20-S	20-S	
10,500	22½	22	22	22-S	22-S		24	22	21	21	21	
11,000	23	22	22	22-S	22-S		24½	22½	22	22	22	
11,500	23½	23	23	23-S	23-S		25	23	22½	22½	22½	
12,000	24	24	24	24-S	24-S		26	24	23	23	23	
12,500	24½	24-S	24-S	24-S	24-S		27	24½	23½	23½	23½	
13,000	25	25	25	25-S	25-S		28	25	24	24	24	
13,500	25½	25-S	25-S	25-S	25-S		29	25½	24½	24½	24½	
14,000	26	26	26	26-S	26-S		30	26	25	25	25	
14,500	26½	26-S	26-S	26-S	26-S		31	26½	25½	25½	25½	
15,000	27	27	27	27-S	27-S		32	27	26	26	26	
15,500	27½	27-S	27-S	27-S	27-S		33	27½	26½	26½	26½	
16,000	28	28	28	28-S	28-S		34	28	27	27	27	
16,500	28½	28-S	28-S	28-S	28-S		35	28½	27½	27½	27½	
17,000	29	29	29	29-S	29-S		36	29	28	28	28	
17,500	29½	29-S	29-S	29-S	29-S		37	29½	28½	28½	28½	
18,000	30	30	30	30-S	30-S		38	30	29	29	29	
18,500	30½	30-S	30-S	30-S	30-S		39	30½	29½	29½	29½	
19,000	31	31	31	31-S	31-S		40	31	30	30	30	
19,500	31½	31-S	31-S	31-S	31-S		41	31½	30½	30½	30½	
20,000	32	32	32	32-S	32-S		42	32	31	31	31	
20,500	32½	32-S	32-S	32-S	32-S		43	32½	31½	31½	31½	
21,000	33	33	33	33-S	33-S		44	33	32	32	32	
21,500	33½	33-S	33-S	33-S	33-S		45	33½	32½	32½	32½	
22,000	34	34	34	34-S	34-S		46	34	33	33	33	
22,500	34½	34-S	34-S	34-S	34-S		47	34½	33½	33½	33½	
23,000	35	35	35	35-S	35-S		48	35	34	34	34	
23,500	35½	35-S	35-S	35-S	35-S		49	35½	34½	34½	34½	
24,000	36	36	36	36-S	36-S		50	36	35	35	35	
24,500	36½	36-S	36-S	36-S	36-S		51	36½	35½	35½	35½	
25,000	37	37	37	37-S	37-S		52	37	36	36	36	
25,500	37½	37-S	37-S	37-S	37-S		53	37½	36½	36½	36½	
26,000	38	38	38	38-S	38-S		54	38	37	37	37	
26,500	38½	38-S	38-S	38-S	38-S		55	38½	37½	37½	37½	
27,000	39	39	39	39-S	39-S		56	39	38	38	38	
27,500	39½	39-S	39-S	39-S	39-S		57	39½	38½	38½	38½	
28,000	40	40	40	40-S	40-S		58	40	39	39	39	
28,500	40½	40-S	40-S	40-S	40-S		59	40½	39½	39½	39½	
29,000	41	41	41	41-S	41-S		60	41	40	40	40	
29,500	41½	41-S	41-S	41-S	41-S		61	41½	40½	40½	40½	
30,000	42	42	42	42-S	42-S		62	42	41	41	41	
30,500	42½	42-S	42-S	42-S	42-S		63	42½	41½	41½	41½	
31,000	43	43	43	43-S	43-S		64	43	42	42	42	
31,500	43½	43-S	43-S	43-S	43-S		65	43½	42½	42½	42½	
32,000	44	44	44	44-S	44-S		66	44	43	43	43	
32,500	44½	44-S	44-S	44-S	44-S		67	44½	43½	43½	43½	
33,000	45	45	45	45-S	45-S		68	45	44	44	44	
33,500	45½	45-S	45-S	45-S	45-S		69	45½	44½	44½	44½	
34,000	46	46	46	46-S	46-S		70	46	45	45	45	
34,500	46½	46-S	46-S	46-S	46-S		71	46½	45½	45½	45½	
35,000	47	47	47	47-S	47-S		72	47	46	46	46	
35,500	47½	47-S	47-S	47-S	47-S		73	47½	46½	46½	46½	
36,000	48	48	48	48-S	48-S		74	48	47	47	47	
36,500	48½	48-S	48-S	48-S	48-S		75	48½	47½	47½	47½	
37,000	49	49	49	49-S	49-S		76	49	48	48	48	
37,500	49½	49-S	49-S	49-S	49-S		77	49½	48½	48½	48½	
38,000	50	50	50	50-S	50-S		78	50	49	49	49	
38,500	50½	50-S	50-S	50-S	50-S		79	50½	49½	49½	49½	
39,000	51	51	51	51-S	51-S		80	51	50	50	50	
39,500	51½	51-S	51-S	51-S	51-S		81	51½	50½	50½	50½	
40,000	52	52	52	52-S	52-S		82	52	51	51	51	
40,500	52½	52-S	52-S	52-S	52-S		83	52½	51½	51½	51½	
41,000	53	53	53	53-S	53-S		84	53	52	52	52	
41,500	53½	53-S	53-S	53-S	53-S		85	53½	52½	52½	52½	
42,000	54	54	54	54-S	54-S		86	54	53	53	53	
42,500	54½	54-S	54-S	54-S	54-S		87	54½	53½	53½	53½	
43,000	55	55	55	55-S	55-S		88	55	54	54	54	
43,500	55½	55-S	55-S	55-S	55-S		89	55½	54½	54½	54½	
44,000	56	56	56	56-S	56-S		90	56	55	55	55	
44,500	56½	56-S	56-S	56-S	56-S		91	56½	55½	55½	55½	
45,000	57	57	57	57-S	57-S		92	57	56	56	56	
45,500	57½	57-S	57-S	57-S	57-S		93	57½	56½	56½	56½	
46,000	58	58	58	58-S	58-S		94	58	57	57	57	
46,500	58½	58-S	58-S	58-S	58-S		95	58½	57½	57½	57½	
47,000	59	59	59	59-S	59-S		96	59	58	58	58	
47,500	59½	59-S	59-S	59-S	59-S		97	59½	58½	58½	58½	
48,000	60	60	60	60-S	60-S		98	60	59	59	59	
48,500	60½	60-S	60-S	60-S	60-S		99	60½	59½	59½	59½	
49,000	61	61	61	61-S	61-S		100	61	60	60	60	
49,500	61½	61-S	61-S	61-S	61-S							
50,000	62	62	62	62-S	62-S							
50,500	62½	62-S	62-S	62-S	62-S							
51,000	63	63	63	63-S	63-S							
51,500	63½	63-S	63-S	63-S	63-S							
52,000	64	64	64	64-S	64-S							
52,500	64½	64-S	64-S	64-S	64-S							
53,000	65	65	65	65-S	65-S							
53,500	65½	65-S	65-S	65-S	65-S							
54,000	66	66	66	66-S	66-S							
54,500	66½	66-S	66-S	66-S	66-S							
55,000	67	67	67	67-S	67-S							
55,500	67½	67-S	67-S	67-S	67-S							
56,000	68	68	68	68-S	68-S							
56,500	68½	68-S	68-S	68-S	68-S							
57,000	69	69	69	69-S	69-S							
57,500	69½	69-S	69-S	69-S	69-S							
58,000	70	70	70	70-S	70-S							
58,500	70½	70-S	70-S	70-S	70-S							
59,000	71	71	71	71-S	71-S							
59,500	71½	71-S	71-S	71-S	71-S							
60,000	72	72	72	72-S	72-S							
60,500	72½	72-S	72-S	72-S	72-S							
61,000	73	73	73	73-S	73-S							
61,500	73½	73-S	73-S	73-S	73-S							
62,000	74	74	74	74-S	74-S							
62,500	74½	74-S	74-S	74-S	74-S							
63,000	75	75	75	75-S	75-S							
63,500	75½	75-S	75-S	75-S	75-S							
64,000	76	76	76	76-S	76-S							
64,500	76½	76-S	76-S	76-S	76-S							
65,000	77	77	77	77-S	77-S							
65,500	77½	77-S	77-S	77-S	77-S							
66,000	78	78	78	78-S	78-S							
66,500	78½	78-S	78-S	78-S	78-S							
67,000	79	79	79	79-S	79-S							
67,500	79½	79-S	79-S	79-S	79-S							
68,000	80	80	80	80-S	80-S							
68,500	80½	80-S	80-S	80-S	80-S							
69,000	81	81	81	8								

Hot Water Heating Systems

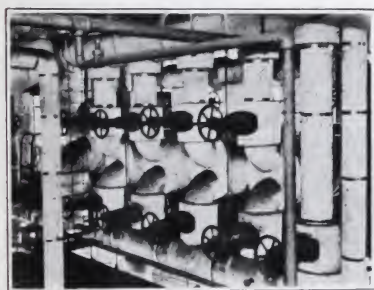
Convertors

The Whitlock Type "R" Instantaneous heater is widely used in hot water heating systems. As so applied, the heater is usually known as a convertor. Steam is led to the shell of the convertor either from the power plant exhaust or direct from the boilers. Water is passed through the heating section of the convertor and then goes directly to the radiation. Cool water is returned from the radiation to the convertor.

In the "gravity circulation" method, Figure 8, the flow through the system is induced by the difference in specific weight between the ascending column of hot water leading to the radiation and the column of cool water coming away from the radiation.

In the "forced circulation" method, Figure 6 and Figure 7, flow is induced by means of a pump.

The advantages of the gravity method are simplicity, absence of any moving parts and elimination of power cost for promoting the circulation.



Battery of Whitlock Type "R" Convertors installed in a manufacturing plant.

The advantages of the forced method are, on the whole, more pronounced. They include the possibility of using smaller pipe lines to supply a given amount of radiation, a smaller convertor for a given duty, the ability to carry the heating water for long horizontal distances, the ease of exact control, and the possibility of carrying relatively heavy over-loads.

In gravity systems both the pipe lines and convertors must be so proportioned as to keep the water velocity between 50 ft. per minute and 100 ft. per minute as the total head available to effect the circulation is relatively small and the losses due to friction must therefore be kept extremely low.

In the forced system, the water velocity may be raised to 250 to 300 ft. per minute or even higher.

Whitlock Type "R" convertors are frequently used for house heating in communities where steam is supplied from a central plant.

Whitlock Type "R" convertors are regularly built for both gravity and forced circulation, the design and construction being carefully proportioned in each case, to meet the desired operating conditions.

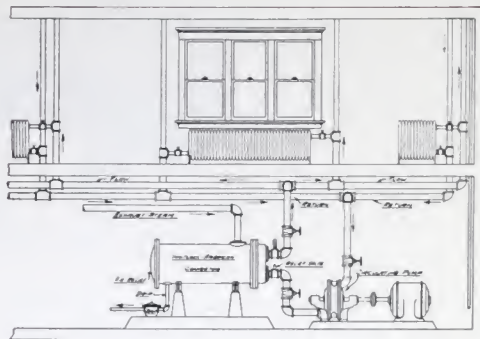


Fig. 6. Typical Installation — Type "R" Convertor — Forced Circulation

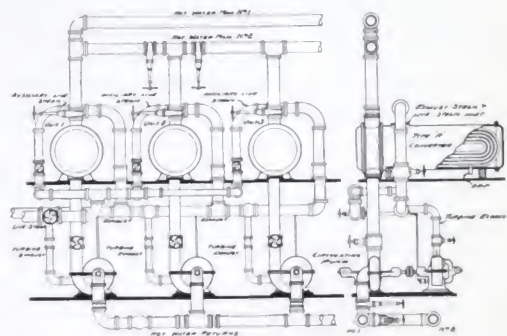


Fig. 7 Typical Piping Plan of 3 Type "R" Convertors Connected in Parallel

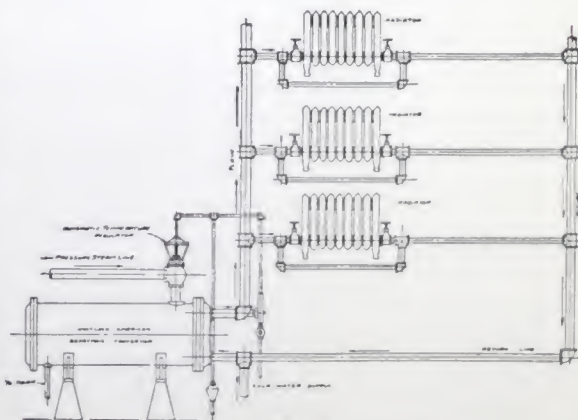


Fig. 8
Typical Piping Plan — Single Type "R" Convertor — Gravity Circulation

Condensation Coolers and Preheaters



FIG. 9

Whitlock 4 Pass Type R Condensation Cooler

Returns from heating systems and various steam apparatus are piped to the shell of the heater while fresh cold water is led through the heating section. A system of baffles keeps the condensation in close contact with the tubes through which the water is circulating. The condensation is thus cooled and the service water preheated before going to the main service heater. These coolers are especially useful where the steam used is purchased from an outside source and condensation cannot be returned to the boiler. These installations are sometimes called "Economizers."

It is frequently illegal and always inadvisable to discharge hot returns directly to the sewer. Saving this heat is decidedly worthwhile and it will be found economical in the long run to install a cooler with sufficient surface to recover a large proportion of this heat. For further information on these coolers write for our Bulletin No. 100.

TABLE 9
CAPACITIES OF CONDENSATION COOLERS

Number Of Square Feet Of Radiation	Equivalent Condensation In Pounds Per Hour	Cooling Condensation 200° — 125° While Heating An Equal Amount of Service Water 40° — 115°	Cooling Condensation 200° — 100° While Heating Twice The Amount of Service Water 40° — 90°	Cooling Condensation 200° — 89° While Heating Three Times The Amount of Service Water 40° — 77°
		Type "R" Cooler	Type "R" Cooler	Type "R" Cooler
1000	250	1	2	3
1500	375	2	4	5
2000	500	3	5	6
2500	625	5	6	7
3000	750	5	7	8
3500	875	6	7	8
4000	1000	7	8	9
5000	1250	8	9	10
6000	1500	9	10	11
7000	1750	9	10	11
8000	2000	10	11	12
10000	2500	11	12	13
12500	3125	12	13	14
13000	3750	13	14	15
17500	4275	13	14	15
20000	5000	14	15	16
25000	6250	14	15½	17
30000	7500	15	16	18
35000	8750	15½	17	18
40000	10000	16	18	18½

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